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ABSTRACT

This study discusses the development of a qualitative assessment to profile prosodic skills of Cantonese-speaking children with speech defects, and correlates it with a quantiative assessment of productive skills. The study entails the use of the Visi-pitch to provide objective data for assessment. The aim is to devise a comprehensive description of prosodic skills for purposes of assessment and intervention. Videotape recordings were made of each subject in a sound-treated studio with a one-side viewing window and mounted cameras. Each recording session consisted of a mother-child interaction in a naturalistic conversational environment. The mother of each child was to elicit the child to tell a story using a picture story book, and to talk about what they did over the weekend. The analytic approach involved transcription of the video recording at the morphological and phonological levels. The transcribed units were then divided into tone units. For each subject, the results were summarized on a profile. The recordings were analyzed by two experimenters, and the results were compared. The reliability of the profile description of each subject's performance was also assessed by reviewing other parts of the recording of the same subject. (VWL)

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PROSODIC ASPECTS of HEARING-IMPAIRED CHILDREN: A QUALITATIVE and QUANTITATIVE ASSESSMENT

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I. Introduction

The virtual lack of a standardized and clinically useful method to assess the prosodic skills of profoundly hearing-impaired children is a major problem faced by all workers concerned with deaf education in Hong Kong. This problem is imminent, not only because of difficulties in adopting foreign methods due to typological differences between languages, but also because prosodic skills essentially affect other areas of language development. It is of particular importance to the child, whose cognitive development is also closely related to his expressive and receptive skills.

I.1 Language Typology

Methods of assessment of speech and language have been developed in many English-speaking areas (see for example, Grunwell, 1987; Ingram, 1976, 1981; Ling, 1976; Crystal, 1982). A major characteristic of these lie in the over-emphasis of segmental skills. Apart from the Crystal publication, supra-segmental or prosodic skills have been much over-looked and underestimated.

In Hong Kong, the language situation makes this problem more acute. Cantonese is the spoken mother-tongue. Unlike English, Cantonese is a tone language. This means that the same consonant-vowel combination can convey quite different messages, depending on the pitch pattern with which it is produced. For example, the segmental combination /ji/ can mean 'clothing', 'chair', 'meaning', 'child', 'ears' or 'two', depending on whether the pitch pattern adopted is one of high level, high rising, mid level, low falling, low rising or low level respectively. Figure 1 shows the fundamental frequency patterns of the six tones produced by a female native speaker of Cantonese. A consequence of overlooking this linguistically significant aspect in any programme of language intervention leads to defective prosodic skills, the most essential aspect of language skills.

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I.2 Prosodic skills

Prosody refers to pitch, intensity and duration. The linguistic uses of these for distinctive purposes in Cantonese are shown in the lexical tone patterns (as indicated in Figure 1). The interactions between pitch and intensity contribute to tonal distinctions and accentuation. Difference in duration is also a significant cue for tonal distinctions (see Figure 2).

In communicative terms, prosodic skills contribute to pragmatic skills for signalling accentuation. Articulatory skills are also dependent on adequate excitation of the vocal tract, which is in turn related to the mastery of an efficient airstream mechanism. Grammatical skills in the use of different sentence types, for signalling boundaries and for performing various speech acts again hinge on the effective use of prosodic skills in production and reception.

Research on 'deaf speech' have shown that prosodic errors essentially lead to poor intelligibility (see e.g. McGarr and Osberger, 1978). Thus, defective prosody can be a major source of difficulty experienced by the deaf who attempt to communicate using speech.

Prosodic skills are among the first skills mastered by the developing infant. Normally hearing babies develop the ability to control the larynx, to use voice quality and pitch changes to communicate long before a contrastive segmental system can be established (Abberton, 1985; Crystal, 1975; Fourcin, 1978). Literature on speech acquisition by Cantonese (Tse, 1978) and Mandarin (Chao, 1951), and many other tone-language-speaking children (see Li and Thompson, 1978 for a review) provide ample evidence with regard to normal acquisition. The preligually deaf child, however, is often characterised by poor phonatory control. The productions are either 'monotonal' or marred by erratic pitch variations which drastically affect comprehensibility. Intervention to foster speech development must be based on the natural acquisitional sequence.

I.3 Hearing-impairment

Auditory disability often leads to degradations

in frequency analytic ability in the peripheral hearing mechanism, so much so that speech patterns cannot be extracted from the acoustic flow of speech. Pitch patterns, which essentially signal lexical contrasts in Cantonese, are crucial to speech communication. The speaker must be able to make use of varying pitch patterns to convey differences in meaning, and understanding speech is also dependent on recognising these prosodic patterns.

All hearing-impaired listeners have residual hearing, which can be usefully employed especially in conveying prosodic differences. The frequency region of usable hearing corresponds well with the fundamental frequency range of normal speakers (see Figure 3). Profoundly hearing-impaired children can be taught to perceive and produce lexical tones in Cantonese (Ching, 1987) if the auditory input can be presented in a clear and usable manner (Fourcin, 1987). For those who depend on lipreading for understanding speech, fundamental frequency information is most useful because varying pitch patterns cannot be seen on the face of the speaker (Rosen et al, 1981; Grant, 1987). Even much greater benefit is obtainable by a lipreader in a Cantonese-speaking environment (Ching, 1985, 1988).

II. Assessment of prosodic skills

The present work attempts to develop a qualitative assessment to profile prosodic skills of children with speech defects, and correlate it with a quantitative assessment of productive skills. The former is indebted to the PROP developed first by Crystal (1982), with much modifications to cater specifically for the Cantonese-speaking context. This present work also entails the use of the Visi-pitch to provide objective data for assessment. The aim is to devise a comprehensive description of prosodic skills for purposes of assessment and intervention.

Video-recordings of each subject were made in a sound-treated studio with one-side viewing window and mounted cameras. Each recording session consisted of a mother-child interation in a naturalistic conversational environment. The mother of each child was to elicit the child to tell a story using a picture story book, and also

to talk about what they did over the past weekend.

The analytic approach involved firstly the transcription of the video-recording at the morphological and phonological/phonetic levels. Each sample was about three minutes of continuous speech. These transcribed material were then divided into tone units. An interlinear method was used to mark varying pitch contours, and information regarding voice quality, pitch range were also noted. Functional and non-functional use of pitch, length and intensity changes were also recorded.

For each subject, the results were summarized on a profile. The recordings were analysed individually by two experimenters, and then results were compared. There was good agreement.

The reliability of the profile description of each subject's performance was also assessed by reviewing other parts of the recordings of the same subject. A longer sample would be used for the construction of the profile to yield a more representative description if the original was found to be deficient.

II.1 Qualitative assessment

The following is a description of the profile used to describe prosodic skills in Cantonese. This is then illustrated by brief accounts of the production of two profoundly hearing-impaired children, aged 6;2 and 13;10 respectively.

The chart recognises three main aspects of the linguistic use of pitch in Cantonese. The analysis on the basis of TONE UNITS focus on the way in which the formal pitch/rhythm contour relates to grammatical structure. Tone units are bounded by pauses.

Incomplete tone units, such as false starts, are recorded separately. Indeterminate items are instances in which ambient noise or unwanted intervention make it difficult to decide whether the productions were complete tone units. These often happen in naturalistic conversational situations. Stereotyped instances are prosodic patterns which are fixed; nursery rhymes or quotes from TV commercials are some of the sources. Pitch

patterns which are direct imitations of the stimulus, and obviously outside of what one would normally expect of the child, would be entered under Imitation in the chart.

All other utterences are analysed in sequence, directly in terms of the general grammatical structure. A tone unit may be equivalent to a clause, for example,

[ˌm ˊpei ˉjɔ] 'I don't want to give it away'

or to a phrase, for example,

[ˉhak ˉsik ˌhai] 'black shoes'.

There are also instances of tone units whose grammatical structure is a single word, for example,

[ˌsy ˊt'iu] 'potato chips'

or a syllable in a di-syllabic word, as in

[ˉkei] 'plane' when [ˉfei ˉkei] aeroplane'

was intended. (This was only evident when the utterance which followed was the full form [ˉfei ˉkei] 'aeroplane'.)

No reference is made to the functions of the tone units. These warrant much more lengthy treatment on their own. Nevertheless, contextual and attitudinal contexts might be listed under Others when contextual imformation contribute to the evaluation of speech. Number of occurrence can also be tallied.

TONE refers to two aspects of laryngeal control, adequate phonation in an appropriate register, and systematic use of fundamental frequency variations in an appropriate range.

Tonal variations are recorded in the space between two lines, which represent the speaker's pitch range on the basis of auditory judgement. Utterances are then transcribed in sequence. In disordered prosody, pecularities of pitch range (narrowing, widening) and phonation type

(breathiness, hoarseness, etc) might be expected, and must be noted on the chart.

Under tonal contrasts, the six pitch patterns (refer to Figure 1 for their fundamental frequency contours) responsible for making lexical contrasts in Cantonese are listed. Only pitch patterns used distinctively are noted down. Phonetic variants are not subclassified, unless these fall outside the normal child and adult usage.

Tonal contours occurring in an especially narrow range must be recorded, as these might give rise to uncertainty as to whether a high rising or low rising tone was used, or whether the tones were falling or level.

The third section refers to the use of INTONATION and ACCENTUATION on the sentence and word level, particularly to the overall pitch/rhythm pattern of the utterance, including all particles, which are an essential feature of spoken Cantonese. Many of the grammatical structures need to be pronounced in the appropriate intonation for them to be understood as statements or questions. Particles must also be used with the correct intonational contour for correct interpretation.

Relative loudness is directly related to the proportion of content words to function words (particles) in the utterance. Relative pitch of the words relate to the systematic modifications of tonal contours in certain contexts, and the pitch pattern of the functional particles. Tonal patterns are inherent contrastive patterns of content words and function words. Continuity applies specifically to words which are made up of more than one syllable.

The following brief accounts of the profiles of two profoundly hearing-impaired children illustrate the practical application of the approach.

SUBJECT 2

Subject 2 is a six-year-old child with an average hearing loss of 100 decibels over the four frequencies (250 Hz, 500 Hz, 1000 Hz and 2000 Hz). She has good filtering characteristics at frequencies below 500 Hz. (see Figure 4 for her pure tone audiogram).

Her profile (Table 1) shows that she produces clauses and phrases with a coherent prosodic structure. She has adequate phonatory control, and her fundamental frequency range is normal, both in its register and range. Her productions, however, demonstrate a reduced inventory of four-tone contrasts. Most of her productions were statements in the appropriate intonation. The lack of other sentence types may be a function of the activity at the recording session. Further analysis of the productions in other contexts and at other times would give a better picture of her productive skills. She produces inadvertently loud utterances when the situation does not necessitate it.

On the basis of the profile, intervention should initially concentrate on helping her to monitor the loudness of her own production. The usage of particles with the appropriate intonation for asking questions and for expressing her intentions need to be worked on. A third objective would be to help expand her tonal inventory.

SUBJECT 4

Subject 4 is a thirteen-year-old profoundly hearing-impaired child. She has a better pure tone audiogram than subject 2 (see Figure 4), but her filtering characteristics at low frequencies are not as good. She has an appreciable measure of phonatory control, but still has difficulties in voice production. This affects her voice register, and her control over the production of tonal contrasts.

Her profile as shown in Table 2 indicated that many of her utterances are incomplete. Her grammatical development is also delayed in comparison with subject 2. She has an uncomfortably high pitch register, with a falsetto voice quality and a very narrow pitch range. High pitch is her 'norm', with a high/low contrast in her production. Pitch changes adventitiously introduced in her speech indicated irregularity of vocal fold vibration. She uses no particles, and produces no variations in sentence type. Her tonal ability is restricted, and not much is gained even when a longer sample was taken.

It is essential to help her improve on her voice quality and bring her register down to the normal

range. It is only then that word-level tonal contrasts may be introduced.

II.2 Quantitative assessment

A set of audio-recording was also made separately with each child by her teacher. This provides supplementary information on production skills of the child, and is particularly useful for analysis using the Visi-pitch. The audio-recordings provide a basis for statistical analysis for the fundamental frequency characteristics of the subject.

The chosen sample of data were input to an Apple IIe computer via a Visi-pitch and an analog-to-digital converter. Comprehensive statistics regarding the range and absolute frequency variations in the data can be calculated. In Figure 5, the frequency/intensity patterns of an utterance produced by subject 4 is shown side by side with that of her teacher. Summary statistics show that the child's range is 318 Hz - 412 Hz, an unusually high pitch register; as her young lady teacher has a fundamental frequency range of 120 Hz - 265 Hz.

A direct comparison illustrates the inappropriately high pitch range employed by the child. Frequency changes were not systematically used, and corresponding intensity changes as an acoustic cue for signalling the correct lexical tone was not used either.

III. Discussion

The profile description and the analysis using the Visipitch can be correlated with the aided and unaided audiograms of the subject to serve as a comprehensive case description. The possibility of storing the sample on a diskette allows easy access for up-dating of information, and for comparisons of the performance of the same subject at regular time intervals. Analysis results can also be stored on diskettes for easy access. Particularly for centres and schools where there are heavy caseloads, time and space are important considerations.

The possibilities of comparing data on-line also enables the teacher to devise training programmes

suited to individual needs at different times. For example, one of the aims of the training programme for Subject 4 would be to work on bringing down the range of the child to an appropriate level and expanding the range. Subjective impressions must be substantiated by objective measurements in order for the teacher not to have unrealistic expectations, and to be sensitive to small but steady improvements. Achievements which can be charted permit systematic monitoring of progress.

The present work is concerned with assessing prosodic skills in production. Perceptual tests using specific speech patterns, natural and synthetic, are essential to a better understanding of the speech skills of the subject (Ching, 1988). The enhancement of prosodic skills can also be attained when a clear auditory input and a visual display are used (Ching, 1989). It is only through a clarification in input and an insight into the needs of the profoundly deaf that speech skills can be profitably improved.

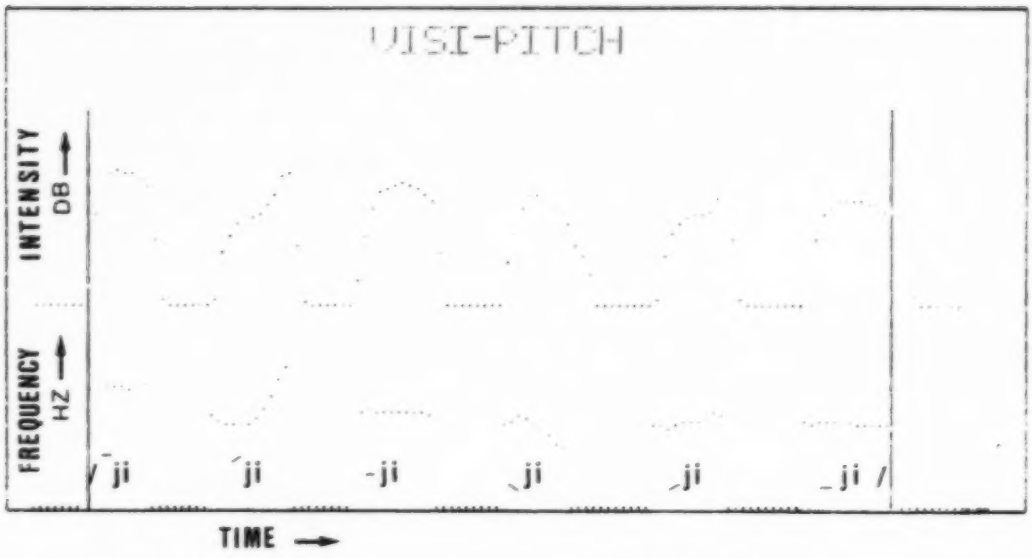

Figure 1 Fundamental frequency patterns of the six lexical tones in Cantonese, with their corresponding intensity patterns

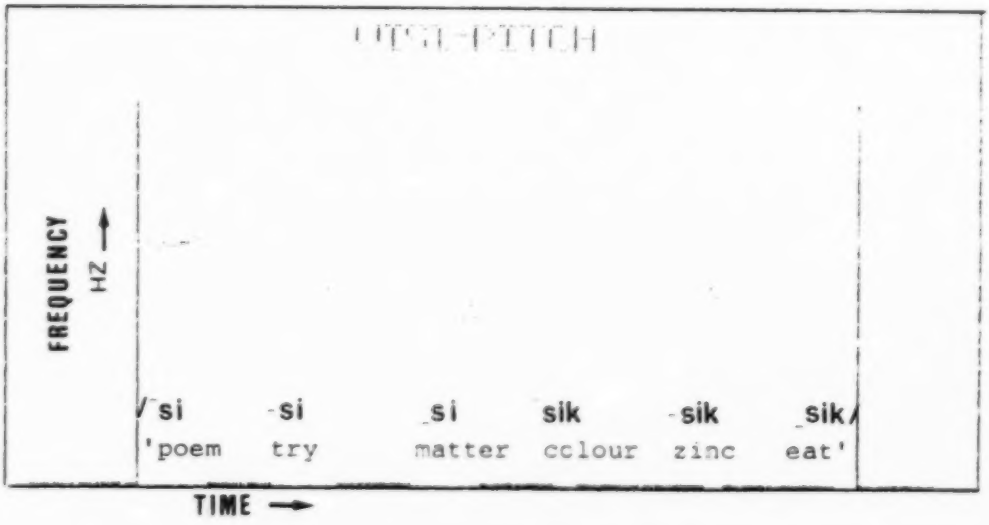

Figure 2 Fundamental frequency patterns of the three level tones in open and closed syllables. Final plosives are all unreleased in Cantonese, so the perceptual distinction between the two syllable types is essentially one of duration.

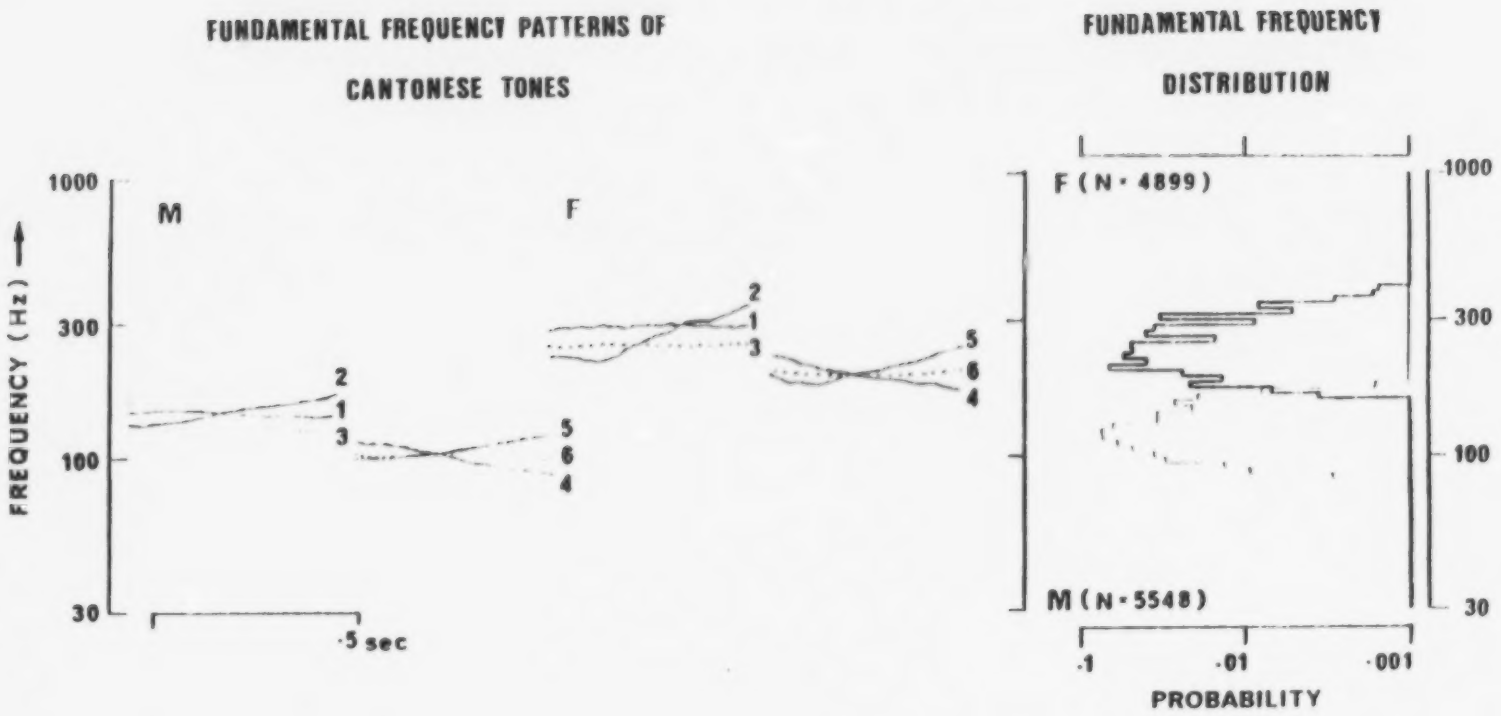

Figure 3 The six tones: 1 High Level; 2 High Rising; 3 Mid Level; 4 Low Falling; 5 Low Rising; 6 Low Level; produced by a male (M) and a female (F) speaker. N is the number of periods counted for constructing the distribution histograms. It can be seen that the fundamental frequency range for tonal variations is well within the range in which even the profoundly deaf will have some residual hearing.

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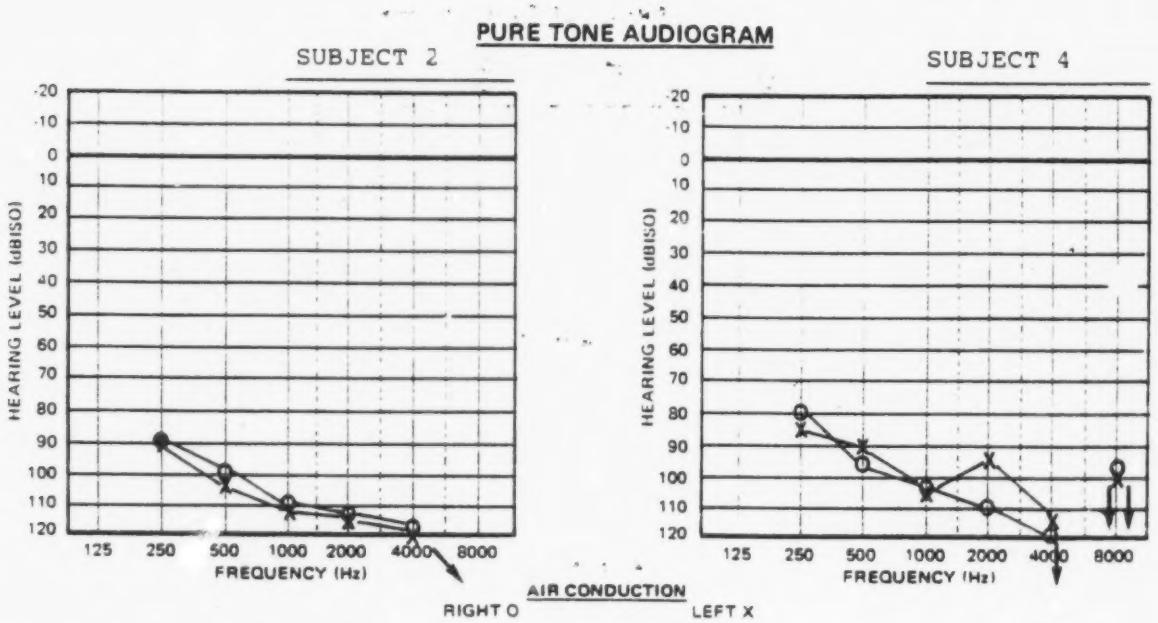
PURE TONE AUDIOGRAM
SUBJECT 2
SUBJECT 4
HEARING LEVEL (dBISO)
FREQUENCY (Hz)
125 250 500 1000 2000 4000 8000
-20 -10 0 10 20 30 40 50 60 70 80 90 100 110 120
AIR CONDUCTION
RIGHT O
LEFT X

Figure 4 Pure tone audiograms for Subject 2 and Subject 4.

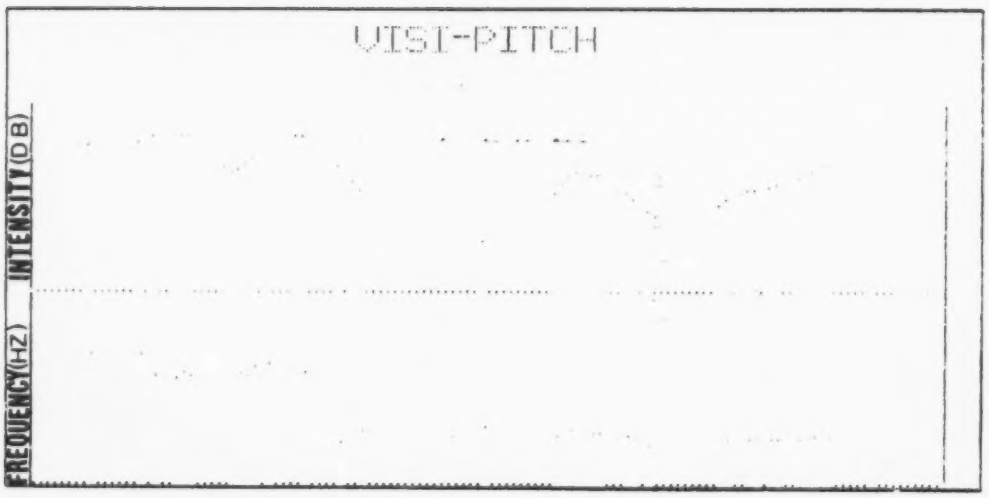

Figure 5 The fundamental frequency and intensity patterns of / -høy ˇjau ´søy / 'go swimming' produced by Subject 4 (left) and her teacher (right).

Name SUBJECT 2 Age 6;2 Sample date Type FREE PLAY

I Tone Unit

Incomplete	Indeterminate	Stereotyped	Imitation
0	0	0	0

Clause	18
Phrase	14
Word	6
Syllable	

Others

Total 38

II Tone

Height \ Range	Wide	Narrow	Normal
High			
Low			
Normal			✓

Tonal Contrasts	Range: Normal	Range: Compressed	Imitation	Others
High Level	✓			Glottal -ised
High Rising	✓			Falsetto
Mid Level	✓			Creaky
Low Falling	✓			Voice
Low Rising				
Low Level				

III Intonation & Accent -uation

	+	-
Sentence type		
Statement	✓	
Question		
Recall		
Command		
Interjection		

Others
Timing
Rhythm

Word	Relative loudness +	Relative loudness -	Relative pitch +	Relative pitch -	Tone pattern +	Tone pattern -	Continuity +	Continuity -
content		✓	✓		✓		✓	
function		✓	✓			✓	✓	

Other remarks

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Table 1 Prosodic profile of Subject 2

Name SUBJECT 4 Age 13;10 Sample date Type FREE PLAY

I Tone Unit	Incomplete 18	Indeterminate 2	Stereotyped 0	Imitation 0	
	Clause 13			Others	
	Phrase 16				
	Word 5				
	Syllable			Total 34	

II Tone	Height \ Range	Wide	Narrow	Normal	
	High		✓		
	Low				
	Normal				
	Tonal Contrasts	Range: Normal	Range: Compressed	Imitation	Others
	High Level		✓		Glottal -ised
	High Rising				Falsetto ✓
	Mid Level				Creaky
	Low Falling				Voice
	Low Rising				Erratic pitch variations
	Low Level		✓		

III Intonation & Accent -uation	Sentence type	+	-	Others Timing
	Statement	✓		
	Question			Rhythm
	Recall			chanting; inapp.
	Command			utterance final engthening
	Interjection			

Word	Relative loudness		Relative pitch		Tone pattern		Continuity	
	+	-	+	-	+	-	+	-
content	✓			✓		✓	✗	
function								

Other remarks

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Table 2 Prosodic profile of Subject 4

REFERENCES

Abberton E. 1985. Diagnostic implications of phonological analysis? New Zealand Speech-Language Therapists' Journal, vol. XL, no.1. 2-16.

Chao, Y.R. 1951. The Cantian dialect: an analysis the Chinese spoken by a twenty-eight-months -old-child. Studies in child language development, ed. by C.A. Ferguson and D.I. Slobin. New york: Holt, Rinehart and Winston.

Ching, Y. C. 1985. Lipreading Cantonese with voice pitch. Journal of Acoustical Society of America, 77, s39. Abs.

------- 1987. Voice pitch information for the deaf. Proceedings of the 1st Asian-Pacific Regional Conference on Deafness. Hong Kong: Hong Kong Society for the Deaf. 340-343.

------- 1988. Lexical tone perception by Cantonese deaf children. Cognitive aspects of the Chinese language, vol.1, ed. by I.M. Liu, H.C. Chen and M.J. Chen. Hong Kong: Asian Research Sevice. 93-102.

------- 1989. Tones for profoundly deaf tone-language speakers. Paper presented at the 2nd Asian-Pacific Regional Conference on Deafness. Jakarta, Indonesia.

Crystal, D. 1975. Non-segmental phonology in language acquisition. The English tone of voice. London: Edward Arnold. Chap. 8.

------- 1982. Profiling linguistic disability. London: Edward Arnold. Reprinted 1987.

Fourcin, A.J. 1978. Acoustic patterns and speech acquisition. The development of communication, ed. by N. Waterson and C. Snow. London: John Wiley.

------- 1987. Hearing aids for tonal languages. Proceedings of the 1st Asian-Pacific Regional Conference on Deafness. Hong Kong: Hong Kong Society for the Deaf.

Grant, K.W. 1987. Identification of intonation contours by normally hearing and profounding hearing-impaired listeners. Journal of Acoustical Society of America 82, 1172-1178.

Grunwell, P. 1987. Clinical phonology. 2nd ed. London: Croom Helm.

Ingram, D. 1976. Phonological disability in children. London: Edward Arnold.
------- 1981. Procedures for the phonological analysis of children's language. Baltimore: University Park Press.

Li, C.N. and Thompson, S.A. 1978. The acquisition of tone. Tone: a linguistic survey, ed. by V.A. Fromkin. New York: Academic Press.

Ling, D. 1976. Speech and the hearing-impaired child: theory and practice. The Alexander Graham Bell Assn for the Deaf, Inc. Washington.
--------- Teacher/Clinician's planbook and guide to the development of speech skills. The Alexander Graham Bell Assn for the Deaf, Inc. Washington.

McGarr, N.S. and Osberger, M.J. 1978. Pitch deviancy and intelligibility of deaf speech. Journal of Communication Disorders 11, 237-247.

Rosen, S., Moore, B.C.J. and Fourcin, A.J. 1981. Voice pitch as an aid to lipreading. Nature 291, 150-152.

Tse, K.P. 1978. Tone acquisition in Cantonese: a longitudinal case study. Journal of Child Language 5, 191-204.

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